A NEW FRUIT ROT OF TOMATOES[1]

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(WITH PLATE VII)

During the summer of 1921 a fungus growth following cracking of the fruit was noted on tomatoes in several localities of Burlington and other counties in New Jersey (fig. 1). The cracking was obvious on both green and ripe fruit of the Stone, Baltimore, and Bonny Best varieties, but was especially prominent and severe on the latter. The cracking is apparently due to one or more physiological causes. An examination showed a very dense fluffy growth of *Oidium lactis* Fres. in the open cracks of ripe fruit lying on the ground and those hanging on the plant to a height of several inches above the soil. This fungus, under field conditions, penetrated the interior of the tomato, and reduced the fruit to a soft rotten mass in from two to five days. The disease was very common throughout the tomato ripening period in the fields under observation. No infection was noted on uninjured ripe fruit, cracked green fruit, or other parts of the plant.

CAUSE.—The rot is due to *Oidium* or *Oospora lactis*. The fungus is repeatedly isolated from infected tomatoes. It causes rapid decay of ripe fruit at 20° C. in a moist chamber. The mold is grayish white, fluffy, and dense (fig. 2). The mycelial growth is more important than spore production. If, however, a diseased tomato be broken open and spread out in a moist chamber for twenty-four hours at 20° C. (fig. 3), the fungus appears very similar in growth to the *Saccharomyces*. In this form the spore production is abundant, while the mycelial growth is subdued. These two factors of mycelium and spore production may be considered as distinguishable characteristics of this fungus from other fruit rot organisms. The fungus grows abundantly on a large variety of culture media. Its only known method of reproduction is non-

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sexual, typically by means of conidial spore chains. The spores are hyaline, round or oval, and smooth. They vary in size from 2 to 6 $\mu \times 6$ to 40 μ (fig. 5).

SYMPTOMS.—The fungus causes a typical soft rot of injured, ripe tomato fruits. In some cases there is a fermentation action, due to the fungus, which causes the cracks to widen and the juice to flow out (fig. 2). The inner tissue is destroyed, while the peeling is not noticeably attacked, but dries out and remains on the field as a dry, hard shell. In advanced decay the symptoms are not easily distinguished from those of a bacterial soft rot of ripe tomato fruit. The odor is at first agreeable, but becomes very offensive before decay is complete. Decay of cracked green fruit was not observed in the field, but the fungus caused slow decay (fig. 4) in fruit that had begun to ripen.

INOCULATIONS.—Ripe, semiripe, and green tomatoes were placed in running water for an hour, treated fifteen minutes with bichloride of mercury, washed with sterilized water, and placed in dry sterilized glass chambers prepared for inoculation. No infection was obtained by spraying spores on uninjured fruit. The fungus caused rapid decay of sliced ripe tomatoes in four to six days at room temperature, 18–20° C. (fig. 4*a*). It grows very slowly on green or semiripe fruit (fig. 4*b*).

Spores of *Oidium* or *Oospora lactis* were introduced into the solid ripe tomatoes by means of a platinum needle. In forty-eight hours at room temperature there was good growth in all places where inoculated (fig. 2*b*). The growth was abundant for a similar period on deep slices made in the tomato (fig. 2*a*). Ripe tomatoes which were punctured but not inoculated did not become infected in the same chambers where other tomatoes were inoculated (fig. 2*c*).

DISTRIBUTION, PREVALENCE, LOSS.—While no definite data are available to show accurately the distribution of the fungus, THOM[2] states: "The mold variously known as *Oidium* or *Oospora lactis* is another cosmopolitan organism. The same or almost indistinguishable forms are found upon decaying vegetables and fruits, which may give reason for the statement that the odor produced of

[2] THOM, CHAS., Fungi on cheese ripening Camembert and Roquefort. Bur. Animal Ind. Bull. 82. 1–40. *figs. 3.* 1906.

Oidium is that of rotten cabbage." There is considerable literature, too extensive to mention here, dealing with *Oidium lactis* in milk products, particularly the relation of the mold to the flavor of Camembert cheese. Very little of this literature deals with the fungus in relation to plant products. PEROTTI and CRISTOFALETTI,[3] however, have briefly reported the fungus as a parasite appearing in spots on tomatoes in Italy. They suggested that the fungus be called *Oidium lactis solani*.

The largest losses were noted near Moorestown, Burlington County. The disease was prevalent in other localities, and losses were more or less regular over the entire tomato growing area in localities where the disease was observed. While the loss was not serious at any one period, there was a rather high loss for the season.

TABLE I

BONNY BEST TOMATOES

SPRAY TREATMENTS	AUGUST 12			SEPTEMBER 7		
	Examined	Diseased	Percentage diseased	Examined	Diseased	Percentage diseased
1. 4-4-50	171	21	12.2	140	25	17.8
2. Check	95	17	17.7	64	13	20.3
3. 4-4-50	102	12	11.7	120	21	17.5
4. Check	120	19	15.8	65	17	26.1

Data were collected in tomato fields of the so-called second early Bonny Best tomatoes, August 12 and September 7, and from a late crop of Baltimores, September 19. This was during the maximum ripening period of each crop. The data were obtained by counting the total large fruits on ten average plants and also the number that were diseased. It will be noted in table I that the disease was slightly higher on September 7 in the Bonny Best tomatoes than it was on August 12. It is very probable that the conditions favoring infection were more prevalent September 7 than August 12.

The percentages of disease in table II were taken from four series of 4-7 applications inclusive of four liquid spray and dust

[3] PEROTTI, R., and CRISTOFOLETTI, U., A fruit spot of tomato. Staz. Sper. Agric. Ital. 47:169-216. *pls. 3. figs. 9.* 1914.

treatments. It appears from the data given in this table that the disease was checked with wet Bordeaux and dust treatments. Such an interpretation is no doubt correct, but the difference of control on treated and untreated plots is not entirely due to treatments. There were slightly more diseased tomatoes on the untreated plots than were formed on the treated plots. The total yield was less on the untreated plots, because much of the fruit had prematurely ripened and was picked or had fallen. The calculation of the percentages of the disease on the untreated plots with a smaller total of fruit on the ten check plants than was obtained from ten plants

TABLE II

Wet spray and dust treatments	Series 1		Series 2		Series 3		Series 4	
	No. examined on 10 plants	Seven applications, percentage diseased Sept. 19	No. examined on 10 plants	Six applications, Percentage diseased, Sept. 19	No. examined on 10 plants	Five applications, percentage diseased Sept. 19	No. examined on 10 plants	Four applications, percentage diseased Sept. 19
1. Check	166	4.2	110	11.8	123	10.5	130	2.3
2. ½-0-3-50	192	1.5	142	2.8	116	9.0	168	2.4
3. 4-4-50	211	2.9	124	0.8	193	2.0	184	3.2
4. Dust	211	1.9	128	1.5	193	2.0	236	.88
5. 4-3-1½-50	193	1.5	140	0.7	134	4.5	211	.95
6. Check	154	3.6	90	8.8	159	6.3	180	3.3
7. ½-0-3-50	157	2.5	83	4.8	164	3.6	140	2.8
8. 4-4-50	142	1.4	126	2.4	209	0	175	1.7
9. Dust	169	1.2	138	1.5	154	1.3	185	2.1
10. 4-3-1½-50	146	0.7	129	0.8	198	9.6	200	0.5

on the treated plots, therefore, has resulted in a slightly increased percentage of disease in the check over the true percentage of control. It will be noted in table II, however, that there is also a difference of control in the four treatments, which indicates that some slight true control was obtained.

The treatments were planned in connection with the investigation of *Septoria lycopersici* control. The third number in the wet Bordeaux spray represents fish oil soap. The dust was composed of 16 pounds anhydrous copper sulphate, 6 pounds lead arsenate, and 78 pounds of hydrated lime. The wet treatments were applied with a 3-row, 3-nozzle traction spray machine, while the dusts were applied with a hand duster.

Summary

1. A cracking of green and ripe fruit of Bonny Best, Baltimore, and Stone tomatoes in Burlington and other counties of New Jersey, due to one or more physiological causes, was observed to be severe in 1921.

2. *Oidium* or *Oospora lactis* was isolated from infected tomatoes. Inoculations of ripe fruit with this fungus were positive.

3. *Oidium* or *Oospora lactis* is a widely distributed fungus. It is known to appear in milk products, cheeses, decaying vegetables, and fruits. On tomato fruit the fungus mycelium is dense, grayish white, and prominent, while in other cases spores are very prominently produced.

4. The treatments with wet Bordeaux sprays and dusts gave slight control of the disease.

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EXPLANATION OF PLATE VII

Fig. 1.—Cracked ripe and green Bonny Best tomatoes, showing various forms of cracking.

Fig. 2.—Ripe tomatoes inoculated with *Oidium lactis* (after 48 hours' growth in partially dry chamber, 18°–20° C.): *a*, in fresh slices; *b*, punctures; *c*, no inoculation but punctured.

Fig. 3.—Diseased ripe tomatoes spread open in moist chamber for 24 hours at 20° C.; white fungus prominent on open material.

Fig. 4.—Sliced ripe and green tomatoes inoculated with *Oidium lactis* (from 4 to 6 days' growth 18°–20° C. in partially dry chambers): *a*, on sliced ripe fruit; *b*, on green to half ripe fruit; *c*, no inoculation on sliced ripe tomato.

Fig. 5.—*Oidium* or *Oospora lactis:* *a* and *d*, mycelial branches and spores; *b*, spores of various sizes in chains; *c*, spores; *e*, spores in budding-like formation.